FIRE STOP BETWEEN FLOOR SLAB AND CURTAIN WALL OF BUILDING

Inventor: Fritz Kramer, Woodside, N.Y.
Assignee: U. F. Chemical Corp., Woodside, N.Y.

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References Cited
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Primary Examiner—Henry C. Sutherland
Assistant Examiner—James L. Ridgill, Jr.
Attorney, Agent, or Firm—Kurt Kelman et al.

ABSTRACT
A fire stop separating superposed floors of a building having a concrete floor slab and a curtain wall horizontally separated by a gap to permit relative thermal expansion movement of the slab and wall essentially consists of a trough of pliable sheet steel filling the gap, and urea formaldehyde resin foam filling the upwardly open cavity of the trough. The foam chars, but does not burn in the event of a fire so as to retain its cellular structure and much of its thermal insulating properties, and the thin sheet steel can support the light foam and its own weight even at temperatures high enough to reduce the tensile strength of the steel.

5 Claims, 1 Drawing Figure
FIRE STOP BETWEEN FLOOR SLAB AND CURTAIN WALL OF BUILDING

This invention relates to fireproof building construction, and particularly to a fire stop for insulating the floors of a building from each other in the event of a fire.

Modern office buildings and like structures have concrete floor slabs and upright curtain walls of concrete or metal which must be spaced apart slightly to allow for differential thermal expansion. A gap approximately 2–4 inches wide extends along the outer edges of each slab and connects the floors above and below, and must be plugged by a fire stop to prevent propagation of fires between the floors. However, the fire stops employed heretofore provide protection for only limited periods, and recent fires are known to have burned through many floors of supposedly fireproof, newly erected buildings of the type described within a fraction of an hour because of the inadequacy of the conventional fire stops.

It has now been found that a fire stop consisting of a body of urea-formaldehyde resin foam supported on a sheet of steel thin enough to be pliable, yet strong enough to carry its own weight and that of the supported, light resin foam when installed in the gap between a concrete floor slab and an upright curtain wall is more durable in the event of a fire than the materials employed heretofore. The fire stop of the invention does not load the structure with a significant burden, costs very little, and is as durable as any other material of construction when protected against rust, the resin foam being unaffected by atmospheric conditions and parasites.

The fire stop of the invention consists of a trough member of metallic material secured in the gap between a slab element and a wall element of the building to be protected and extending substantially from the inner face of the wall element to the edge face of the floor slab. The upwardly open cavity of the trough is substantially completely filled by a body of urea formaldehyde resin foam.

Other features and many of the attendant advantages of this invention will readily become apparent as the same becomes better understood by reference to the following detailed description of preferred embodiments when considered in connection with the appended drawing in which the sole FIGURE shows a building including a fire stop of the invention in elevational section.

The drawing shows only as much of a high-rise office building as is needed for an understanding of this invention, the remainder of the building being either conventional or duplicating the illustrated features of the invention.

The floor slab 1 of reinforced concrete separates an upper floor from a lower floor, the floors not being shown in detail, and is separated from a curtain wall 2 by an air gap. An elongated trough 3 of galvanized mild steel sheet extends along the entire air gap between the inner face 4 of the curtain wall 2 and the narrow edge face 5 of the floor slab 1.

The trough 3 is of approximately U-shaped cross section, and the leg portions 6, 7 of the U-shape abuttingly engage the faces 4, 5 respectively. A wide, flat lip portion 8 integral with the leg portions 6, 7 engages the upwardly directed major surface 9 of the slab 1 in area contact. In the structure so far described, the trough 3 is fulcrummed on the upper free edge of the slab 1, cannot pivot clockwise because of the abutting engagement of the leg portion 6 with the inner face 4, nor counterclockwise because of engagement of the lip portion 8 with the upwardly directed surface 9 of the slab 1.

A body 10 of urea-formaldehyde resin foam fills the upwardly open receptacle provided by the cavity of the trough 3 and overflows the receptacle to a small extent.

The fire stop essentially constituted by the trough 3 and the foam body 10 is installed by first cutting thin, galvanized sheet steel to the desired size, then bending it into the J-shape of a trough fitting between the faces 4, 5 under resilient compressive stress and ultimately folding the longer leg of the J-shape over the edge of the slab 1 to form the lip 8. If so desired, the sheet steel may be fastened temporarily to the wall face 4 and/or the upper slab surface 9 by drops of quick-curing epoxy cement or by means of adhesive tape to facilitate the bending operation in which the elements of the building itself are employed as bending forms. The only tool required is a pair of tinsnips or strong scissors for cutting the sheet steel employed which may not have to be thicker than 2 mils, and is strong enough even under adverse conditions when it is 5 mils thick. Steel heavier than 0.010 inch is neither necessary nor even desirable under any conditions that I am presently aware of.

Ureaformaldehyde resin foam is prepared from ureaformaldehyde precondensate, compressed air, a surfactant, water, and phosphoric acid as a catalyst in a conventional manner, using the foam generator of Bauer, U.S. Pat. No. 2,860,856 or equivalent equipment. The foam is soft when ejected from the nozzle of the generator which is directed toward the open top of the trough 3. The fresh foam conforms to the trough so as fully to occupy the receptacle available, and is preferably applied in a thickness of at least 4 inches and in slight excess so that it overflows the trough 3 and plugs any cracks that may exist between the trough 3 and the cooperating building elements 1, 2. The foam quickly solidifies and reaches its ultimate mechanical strength within a few days.

In the event of a fire, there is no significant amount of perishable material in the fire stop. The steel sheet is strong enough to carry its own weight and that of the foam (approximately 0.6 lbs./cu. ft.) even if heated close to its softening temperature, an unlikely event. The ureaformaldehyde foam chars gradually and without giving off noxious or combustible vapors when heated beyond its decomposition temperature. If high enough a temperature is maintained long enough, the foam is converted into a cellular carbon body which stills traps air in its cells and thus provides thermal insulation between the two floors separated by the slab 1. The gap between the faces 4, 5 remains sealed regardless of thermally induced relative movement of the building elements 1, 2 during fire on the lower floor. The fire thus cannot make its way from the lower to the upper floor along the curtain wall 2 which is coextensive with both floors.

The mechanical strength of urea-formaldehyde resin foam is relatively low, and that of charred foam is even lower. The foam body 10, however, is not subjected to significant mechanical stresses during its use in a fire stop, and the minimal stresses applied are born by the sheet steel. Both the trough 3 and the foam 10 are resilient enough to absorb the changes in the width of the
gap between the faces 4, 5 due to thermal expansion and contraction of the structural elements 1, 2.

Galvanized sheet steel is preferred because of the rust protection afforded by the zinc coating, but phosphatic conversion coatings and like surface treatments may be resorted to in a known manner. Other metals may be substituted for steel if so desired. Aluminum and its alloys, however, have been found to have melting points too low for performing the intended task, and any metal other than steel and employed for making the trough 3 should have a melting point well above that of aluminum.

No full adequate plastic foam is available at this time to replace the urea-formaldehyde foam described above. Some plastic foams, such as polyurethane foam, are flammable, and others give off noxious or even toxic vapors, as in the case of phenol-formaldehyde resin foam. Urea-formaldehyde resin foam is most economical at this time, and the cost of the fire stops of the invention is minimal both in materials and in labor required for installation. The particular trough illustrated has been found most convenient because of its ability to be shaped at the site by unskilled or semi-skilled workmen without special tools, but modifications of the trough will readily suggest themselves for specific applications. If the leg portion 6 is fastened initially to the wall face 4, it is not necessary to attach the lip portion 8 to the slab surface 9. When the gap between the faces 4, 5 widens due to thermal stresses or otherwise, the lip portion 8 may then slide freely on the slab surface 9.

It should be understood, therefore, that the foregoing disclosure relates only to a preferred embodiment of the invention and that it is intended to cover all changes and modifications in the example of the invention herein chosen for the purpose of the disclosure which do not constitute departures from the spirit and scope of the invention set forth in the appended claims.

What is claimed is:

1. In a building having a horizontal slab element separating a lower floor of the building from an upper floor, said slab element having two major surfaces respectively directed toward said floors and an edge face connecting said major surfaces, a wall element having an inner upright face adjacent said edge face, said faces defining a gap therebetween to permit limited relative movement of said faces in a horizontal direction, said gap connecting said floors, and a fire stop in said gap, the improvement in the fire stop which comprises:

a. a trough member of resilient sheet steel having a thickness of 0.002 to 0.010 inch secured in said gap and extending substantially from one of said faces to the other face,

b. a body of urea-formaldehyde resin foam substantially filling said receptacle,

1. whereby said trough member and said foam absorb the changes in the width of said gap between said faces due to thermal expansion and contraction of said elements.

2. In a building as set forth in claim 1, said trough member being secured to one of said elements and having a lip portion engaging the other element.

3. In a building as set forth in claim 2, said one element being said wall element and said lip portion engaging the major surface of said slab element directed toward an upper floor.

4. In a building as set forth in claim 2, said trough member being of arcuate cross section in a vertical plane perpendicular to said inner face.

5. In a building as set forth in claim 2, said lip portion being planar and substantially parallel to the engaged surface of said slab element.

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